CLASS VI PERMIT APPLICATION NARRATIVE 40 CFR 146.82(a)

Table of Contents

.0 Pi	roject Background and Contact Information	
2.0 Si	te Characterization	
Site Ch	aracterization: List of Appendices:	
Site Ch	aracterization: List of Tables:	
Site Ch	aracterization: List of Figures:	
	ional Geology	
	Regional Maps and Cross Sections	
	Regional Stratigraphy	
	Regional Structural Geology	
2.1.4	Regional Groundwater Flow in the Injection Zone	2
2.2 Loc	al Geology of the Site	
2.2.1		
2.2.2		
2.2.3		
2.2.4	Faulting in the Area of Review	2
2.3	Description of the Confining and Injection Zones	
2.3.1	Confining Zones	2
2.3.2	Injection Zones	3
2.4	Hydrogeology	3
2.4.1		
2.4.2	Local Hydrogeology	4
2.4.3		
2.4.4		
2.4.5		
2.4.6	Water Wells and Data Sets	4
2.4.7	Injection Depth Waiver	4
2.5	Seismicity	4
2.5.1	Seismicity of in the Region	4
2.5.2		
2.5.3		5
2.5.4	Induced Seismicity	5
2.6	Geomechanics	5
2.6.1	Shale Ductility	5
2.6.2	Stresses	5
2.6.3	Pore Pressures	5
2.7	Geochemistry	5
2.7.1		
2.7.2		5
2.7.3	Compatibility of the CO ₂ with subsurface fluids and minerals	6
2.8 Eco	nomic Geology of the Area	6
2.9 Site	Suitability Summary	6
Site Ch	aracterization References	6

3.0	AoR and Corrective Action	73
4.0	Financial Responsibility	73
5.0	Injection Well Construction	74
5.1	Introduction	74
5.2	Construction Procedures [40 CFR 146.82(a)(12)]	74
5.3	Casing and Cementing	74
5.4	Well Construction Details	76
5.5	Well Construction Diagrams	80
6.0	Proposed Stimulation Program [40 CFR 146.82(a)(9)]	85
6.1	Introduction/Purpose	85
6.2	Stimulation Fluids	85
6.3	Additives	85
6.4	Diverters	85
6.5	Stimulation Procedures	85
7.0	Pre-Operational Logging and Testing	86
8.0	Well Operation	87
8.1	Operational Procedures [40 CFR 146.82(a)(10)]	87
8.2	Proposed Carbon Dioxide Stream [40 CFR 146.82(a)(7)(iii) and (iv)]	90
9.0	Testing and Monitoring	91
10.0	Injection Well Plugging	
11.0	Post-Injection Site Care (PISC) and Site Closure	92
12.0	Emergency and Remedial Response	92
13.0	Injection Depth Waiver and Aquifer Exemption Expansion	93
14.0	Other Information	93

1.0 Project Background and Contact Information

Company: CapturePoint Solutions, LLC

Address: 1101 Expy S Suite 150, Allen Tx

Phone: (832) 300-8225

CapturePoint Solutions, LLC (CPS) is a privately owned Texas based company with a focus on developing large scale carbon dioxide capture and sequestration projects with an emphasis on deep geologic storage of CO₂ in saline formations. CPS is a fully owned subsidiary of CapturePoint LLC, which has over one million tons of anthropogenic CO₂ capture, 300+ miles of CO₂ pipelines and multiple CO₂ EOR floods including two EPA approved MRV plans and existing projects that benefit from Federal 45Q tax credits. CapturePoint LLC is also a licensed oil and gas well operator in the state of Louisiana.





Amended plans or demonstrations per this permit application shall be submitted to the UIC Program Director as follows:

- 1) Within one year of an Area of Review (AoR) reevaluation
- Following any significant changes to the facility, such as addition of monitoring wells or newly
 permitted injection wells within the AoR, on a schedule determined by the UIC Program Director,
 or
- 3) When required by the UIC Program Director.

GSDT Submission - Project Background and Contact Information

GSDT Module: Project Information Tracking

Tab(s): General Information tab; Facility Information and Owner/Operator Information tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

Required project and facility details [40 CFR 146.82(a)(1)]

2.0 Site Characterization

3.0 AoR and Corrective Action

The fully completed AoR and Corrective Action Plan Report has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT.

The report covers in detail the computational modelling approach to the delineation of the Area of Review (AoR), the Corrective Action Plan relating to existing well penetrations within the AoR and the Reevaluation Schedule for AoR delineation once operations commence. A thorough review of the geology and the hydrogeology was also supplied as an appendix to the main report, along with a comprehensive bibliography of references utilized during the AoR modelling execution and reporting phase.

The AoR and Corrective Action Plan Report satisfies rule requirements 40 CFR 146.82(a)(13), 146.84(b) and 146.84(c).

AoR and Corrective Action GSDT Submissions

GSDT Module: AoR and Corrective Action

Tab(s): All applicable tabs

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

- ☐ Tabulation of all wells within AoR that penetrate confining zone [40 CFR 146.82(a)(4)]
- ☑ AoR and Corrective Action Plan [40 CFR 146.82(a)(13) and 146.84(b)]
- ☑ Computational modeling details [40 CFR 146.84(c)]

4.0 Financial Responsibility

CapturePoint Solutions LLC (CPS) is providing financial responsibility pursuant to 40 CFR 146.85. CPS expects to be

to cover the costs of potential corrective action, emergency and remedial response, injection well plugging, post-injection site care, or site closure. The required information has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT.

Financial Responsibility GSDT Submissions

GSDT Module: Financial Responsibility Demonstration

Tab(s): Cost Estimate tab and all applicable financial instrument tabs

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Demonstration of financial responsibility [40 CFR 146.82(a)(14) and 146.85]

5.0 Injection Well Construction



5.1 Introduction



5.2 Construction Procedures [40 CFR 146.82(a)(12)]

The drilling and completion of injection and monitoring wells will be completed in such a manner to meet 40 CFR 146.82 (A)(12) and 146.86(b) and to prevent the movement of formation and injection fluids into or between USDWs. During drilling, fluid levels will be monitored, and the appropriate mud weights used to control the movement of formation fluid, detailed information regarding fluid movement and well control events are addressed in Table 3 of the Emergency Identification and Response Action section in the Emergency and Remedial Response Plan.



The long string casing for each well will be set to a depth of approximately 9,800 through all confining layers and injection zones. Cement will be circulated to surface. Cement integrity will be verified by running a Cement Bond Log.

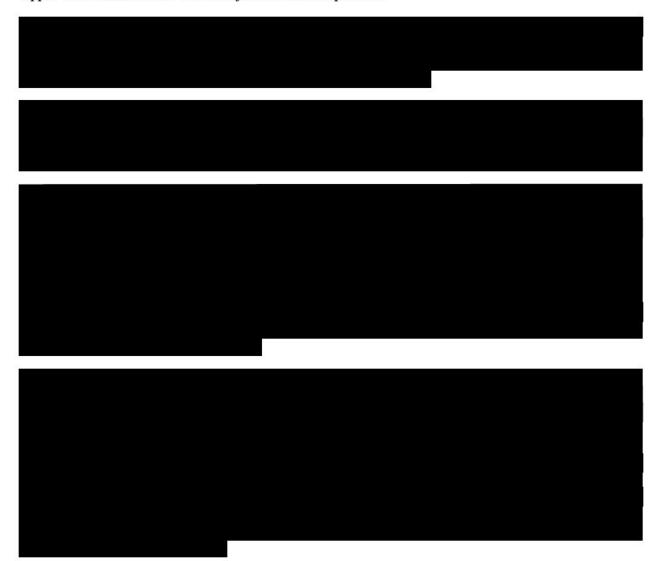
Materials meeting ASTM standards were selected for well construction at this site and were chosen specifically because of their resistance to the effects occurred during exposure to a CO₂ stream and related fluids. Detailed information regarding construction materials is located in section 6.4 of the Testing and Monitoring Plan.

5.3 Casing and Cementing

Well construction materials meet existing industry standards and were selected using ASTM standards and due to their strength and structural characteristics for this case-specific application and to satisfy 40 CFR 146.86(b)(iv). The selected construction materials are designed to withstand downhole conditions such as corrosion, thermal fluctuations, pressures and exposure to formation fluids and the injection stream. Any indication of impacts to structural strength of materials used in the well construction during injection operations will be monitored through implementation of corrosion monitoring at the surface. Details are

contained in section 6.4 in the "Testing and Monitoring Plan" which has been submitted in Module E – Project Plan Submissions.

Table 1 will provide casing depths and open hole diameters. Table 2 will provide the casing specifications. Table 3 will provide the proposed surface and long string cement programs. Tables 4 and 5 will provide the tubing and packer specifications. Figures 1, 2 and 3 provide a well schematic for the proposed Sparta, Upper Wilcox, and Lower Wilcox Injection well completions.



Injection packers will also be visually inspected to ensure no defects are present. A pressure test of the annulus will be conducted during installation of the packer to confirm proper setting and absence of leaks. The annular fluid designed for these wells is 9.0 lb/gal (1.08 Sp. Gr.) sodium chloride brine with inhibitors or equivalent. An annulus monitoring and pressurization system will always maintain the annulus at least 100 psi pressure greater than the injection tubing pressure (Figure 4) is an example of the proposed wellhead and Christmas tree for an injection well and will be used on all 6 wells. The wellhead is a general term used to describe the component at the surface of an oil and gas well that provides the structural and pressure containing interface for production equipment. The primary purpose of a wellhead is to provide the suspension point and pressure seals for the casing strings. The Christmas tree is installed on top of the wellhead and is a set of valves, spools, and fittings used to control the well fluids during production. All

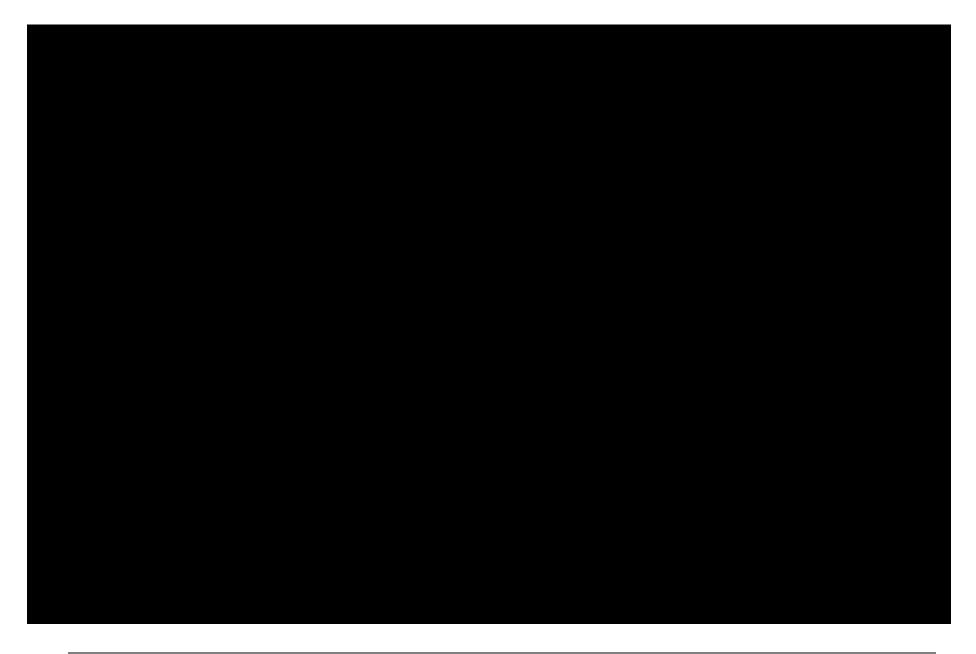
flow-wetted parts of both the wellhead and Christmas tree will be made of CO₂ resistant material.

5.4 Well Construction Details

Tables 1 through 5 provide the casing and cement programs for the injection wells. Injection wells will be constructed to meet the requirements of 40 CFR 146.86. This includes strategies to prevent the movement of fluids into or between USDWs, be constructed to permit the use of downhole tools and workover equipment. Wells will also be constructed using materials meeting ASTM standards and where necessary be constructed using CO₂ resistant materials. During construction both the surface and long string casing will be cemented to surface. This will be followed by running a cement bond log to verify integrity. The last step in well construction will be to perform mechanical integrity tests on each constructed injection well. Construction rules and details are shown in Table 6.

Details pertaining to equipment used in monitoring injection operations of the well(s) is described in the QASP as an attachment to the "Testing and Monitoring Plan". Emergency events and shut-off procedures are described in the "Emergency and Remedial Response Plan". Both of these plans are contained in Module E – Project Plan Submissions.





Construction Details for CapturePoint Solutions LLC Permit Number: LA-0005



Table 5.5. Packer Specifications

Packer Type and Material	Packer Setting Depth (feet)	Length (feet)	Nominal Casing Weight (lbs/ft)	Packer Main Body Outer Diameter (inches)	Packer Inner Diameter (inches)
9 5/8" x 4 1/2" Permanent Packer - Carbon Steel (L-80) body w/ Stainless Steel inner mandrel (wet area - 13Cr L80)	Within 75feet of top of perf	8.52	47	8.125	4.75

Tensile Rating (kbls)	Burst Rating (psi)	Collapse Rating (psi)	Max. Casing Inner Diameter (inches)	Min. Casing Inner Diameter (inches)
489	9,295	8,081	8.681	8.525

Construction Details for CapturePoint Solutions LLC Permit Number: LA-0005

Table 5.6. Summary of Construction Details

CFR Rule	Details
40 CFR 146.86(a) 1-3	Well construction will prevent the movement of fluids between or into USDWs, permit the use of downhole tools and work over equipment, and permit continuous monitoring of the annulus between the casing and injection tubing
40 CFR 146.86(b) 1-3	Casing and cement used in the construction of the well will meet structural requirements, be constructed with materials meeting ASTM standards, and details of construction and depths for wells are shown in Figures 1 through 3.
40 CFR 146.86(b) 4 and 5	Surface and long string casing will be cemented to surface and verified with a cement bond log. Cement used for the long string casing will be CO ₂ resistant, tubing and packer materials will meet ASTM standards. Characteristics of the CO ₂ stream are detailed in the Testing and Monitoring Plan, and injection operation parameters are located in the Well Operations section in Project Information Tracking

5.5 Well Construction Diagrams

Well construction diagrams for each of the injection zones and wellhead schematic is shown in the following page(s).





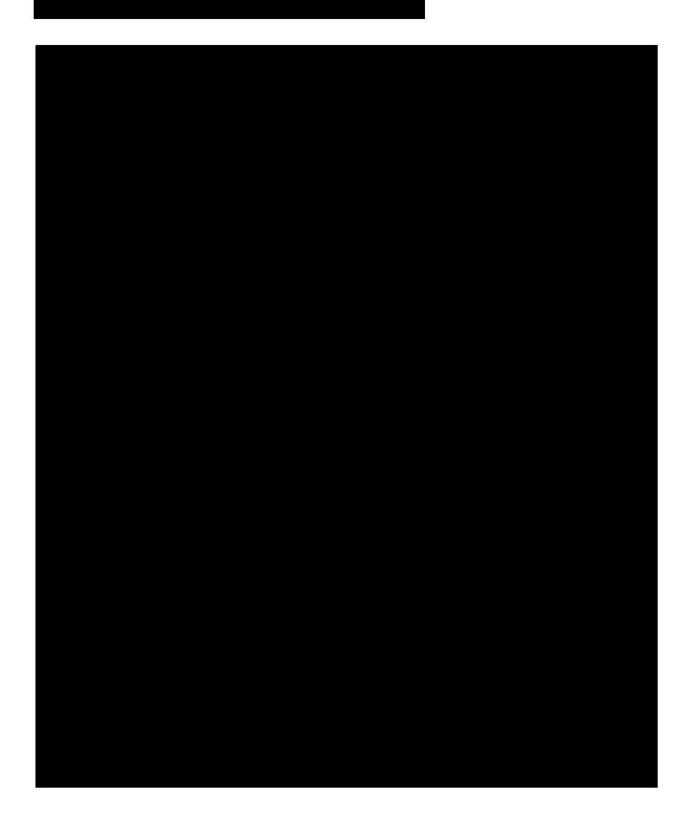
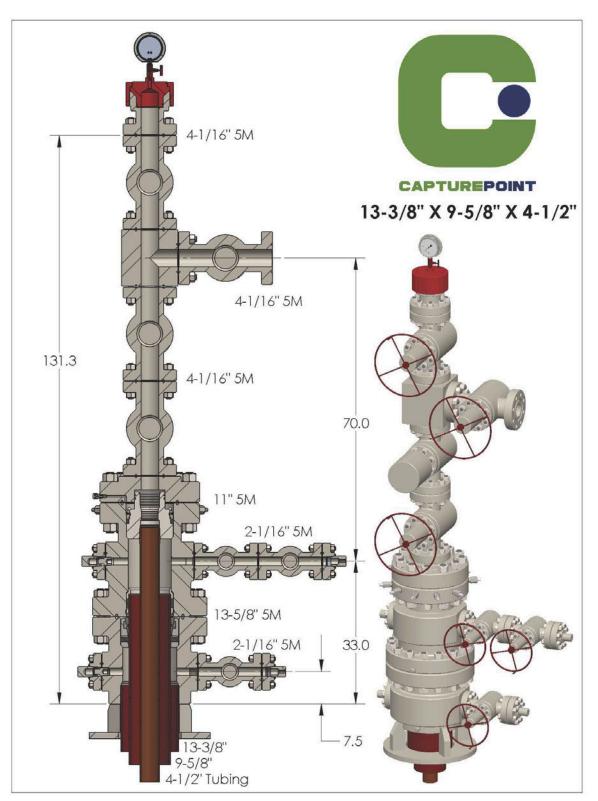
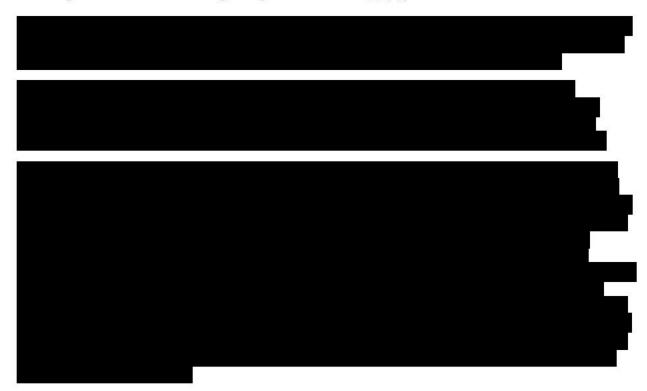


Figure 4. Wellhead and Christmas Tree Schematic



6.0 Proposed Stimulation Program [40 CFR 146.82(a)(9)]



6.1 Introduction/Purpose

Not applicable at this time

6.2 Stimulation Fluids

Not applicable at this time

6.3 Additives

Not applicable at this time

6.4 Diverters

Not applicable at this time

6.5 Stimulation Procedures

Not applicable at this time

7.0 Pre-Operational Logging and Testing

A stratigraphic test well will be drilled into the lowest targeted injection zone. This well will be drilled, cored, fluid samples collected, logged and tested to obtain the necessary information as it pertains to both the confining zone and for each of the three injection zones per the noted rules detailed in **Table 4**.

Upon completion, this well will be constructed as an in-zone monitoring well fitted with DTS/DAS fiberoptic sensors to monitor in-situ changes in temperature and pressure. The drilling and construction of the planned injection wells will require logging and testing of the aforementioned zones.



Prior to injection mechanical integrity tests (MITs) will be performed on each well to verify that mechanical integrity is sound and that there is no risk of endangerment to safety, USDWs or the environment.

Table 7.1. Summary of Data Components and Applicable Rules

Data Component	Rule Reference
	40 CFR 146.86(a)(2)
Well logs	40 CFR 146.87
	40 CFR 146.87(e)(1)
Cores	40 CFR 146.87(b)
Cores	40 CFR 146.82(a)
Fluids	2.5
	40 CFR 146.89(a)(1)
Well MIT	40 CFR 146.87(a)(4)
	40 CFR 146.87(e)(1)
	40 CFR 146.82(a)(8)
Formation characteristics	40 CFR 146.87(b)
Formation characteristics	40 CFR 146.87(c)
	40 CFR 146.87(d)(1)

Pre-Operational Logging and Testing GSDT Submissions

GSDT Module: Pre-Operational Testing

Tab(s): Welcome tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Proposed pre-operational testing program [40 CFR 146.82(a)(8) and 146.87]

8.0 Well Operation

Injection wells will be equipped with continuous pressure, temperature and rate monitoring equipment as well as physically monitored on a daily basis. As a consequence, the operation of wellhead and site valves will not be operated on any regular basis. Only in the event of a compression or supply issue, or scheduled testing will the wells be shut-in from injection. Rate and pressure limits are specified in Tables 5,6 and 7. On shut-in condition, valves should be closed in order from downstream to upstream and reversed on restart of injection. In all cases caution should be taken to avoid the condition of trapped gas between valves at the surface.



8.1 Operational Procedures [40 CFR 146.82(a)(10)]

Operational procedures for the site are to be determined based on formation properties such as fracture pressure and injectivity. A site characterization well will be drilled and provide the necessary information as to provide for a more comprehensive update to the preliminary AoR model and injection simulation for the targeted injection zones. Calculations, assumptions and input parameters for the preliminary AoR modeling and simulation are described in the "AoR and Corrective Action Plan" submitted in Module B. Additional formation data will be collected with each injection well that is drilled at the site. Together the collected data and modeling and simulation will be used to determine Operational Procedures. These protocols are described in the "Pre-Operational Testing Plan" submitted in Module D. As part of the "Pre-Operations Testing Plan" submitted in Module D pursuant to 40 CFR 146.82(a)(8) and 146.87 a step rate test will be run in each well to confirm the fracture gradient and be used to determine injection pressure for the various layers.

Additionally, an injectivity test will be performed for each well to determine amenable volumes that can be injected. Together these formation tests will be used to refine the geologic model and to establish injection rates and volumes. During the operation phase of this sequestration project injection data regarding rates, volumes and temperatures will be continuously monitored per the "*Testing and Monitoring Plan*" submitted in **Module E**. This will include operating data for the targeted injection zones, average and maximum daily rates and volumes of the injected CO₂ stream and average and maximum daily injection pressures per 40 CFR 146.82. Injection data will be provided to the UIC Program Director in semi-annual reports.

The proposed key operating parameters are provided in Tables 5, 6 and 7 for each of the three injection zones. These were calculated based on the formula below. Further details are provided in Section 2.10 of "AOR and Corrective Action Plan" submitted in **Module B**.

Generalized Pressure Equations:

• Max Downhole Injection Pressure = TVD_{fm}* F_g * 90%

• Max Injection Pressure (Surface) = Max Downhole Injection Pressure * TVD_{fm}* H_p * SG CO2 average

Where, $TVD_{fm} = Injection$ zone true vertical depth

 F_g = Fracture pressure gradient

H_p = Hydrostatic pressure gradient

SG CO2 average = Average Injecting CO2 Specific Gravity

Well tests for each injection well will occur once per year unless injection monitoring information indicate more frequent testing. Well work overs will also occur pending the results of continuous monitoring. Though not planned, it is likely that disruptions to the CO₂ supply will occur. These instances may occur as source providers may shut down for scheduled maintenance or because of other operational issues.

Near wellbore damage from salt and/or compressor oil deposition could degrade injectivity over time. In addition, reservoir back pressure could increase as the plume radius increases hence reducing injectivity. Although it should be minimal in these formations.







allowable reservoir pressure with a safety factor of 90% to arrive at the maximum injection pressure which is then used in the AoR model to arrive at the daily injection volumes.

As part of the "Pre-Operations Testing and Logging Plan" submitted in **Module D** pursuant to 40 CFR 146.82(a)(8) and 146.87 a step rate test will be run in each well to confirm the fracture gradient and be used to determine injection pressure for the various layers. Additionally, an injectivity test will be performed in the Sparta for each well to determine amenable volumes that can be injected. Together these formation tests will be used to refine the geologic model and to establish injection rates and volumes.

8.2 Proposed Carbon Dioxide Stream [40 CFR 146.82(a)(7)(iii) and (iv)]



Characteristics of the CO₂ stream are described in Section 2.11 in the "AoR and Corrective Action Plan" submitted in **Module B**. Below are some excerpts from that section that describe the corrosive nature and likely behavior of CO₂ in the subsurface.

It is known that CO₂ and water will form Carbonic Acid (H₂CO₃) which in turn has the capability to dissolve calcium species in the formation. This can alter formation permeability and porosity depending on the native mineralogy. At the injection wellbore this can be an issue for well casing however, the dry dense phase CO₂ will continuously dry the area around the wellbore inhibiting any corrosion by absorbing the formation water and moving deeper into the formation.

The injected CO₂ at the Rapides One CCS site is expected to be soluble in water, which can provide a significant CO₂ trapping mechanism. This feature affects the reservoir by causing the higher density brine to sink within the formation thereby trapping the CO₂-entrained brine. This dissolution allows for an increased storage capacity and decreased fluid migration.

Materials exposed to the CO₂ injection stream will be monitored throughout the injection phase of the project, methods of monitoring are also addressed in the "*Testing and Monitoring Plan*" submitted in **Module E**. All materials with exposure to the injection stream were selected based on their resistance to corrosion when exposed to CO₂ and CO₂-related fluids.

9.0 Testing and Monitoring

The Testing and Monitoring Plan Report has been submitted via the GSDT in 'Confidential Business Information' form. All tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the overall strategy and approach for testing and monitoring, carbon dioxide stream analysis, continuous recording of operational parameters, corrosion monitoring, above confining zone monitoring, external mechanical integrity testing, pressure fall off testing, carbon dioxide plume and pressure front tracking, environmental monitoring at the surface, sampling/analytical procedures. A Class IV well Quality Assurance and Surveillance Plan (QASP) was submitted as an appendix along with additional information relation to project management, data generation and acquisition, assessment and oversight and data validation and usability.

The Testing and Monitoring Plan Report satisfies rule requirements 40 CFR 146.82(a)(15) and 146.90.

Testing and Monitoring GSDT Submissions

GSDT Module: Project Plan Submissions **Tab(s):** Testing and Monitoring tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Testing and Monitoring Plan [40 CFR 146.82(a)(15) and 146.90]

10.0 Injection Well Plugging

An Injection Well Plugging Plan has been developed and electronically submitted to the GSDT pursuant to 40 CFR 146.82(a)(16) and 146.92(b). The plan describes the materials that are to be used and includes a plugging schematic representative for all injection wells.

The Injection and Well Plugging Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the planned tests and measurements to determine the bottom hole reservoir pressure, Planned External Mechanical Integrity Test, Information on Plugs, methods used for volume calculations, notifications, permits and inspections required, plugging procedures and contingency procedures/measures. Plan revision number: v1 Plan revision date: 03/26/2021

The Injection and Well Plugging Plan satisfies rule requirements 40 CFR 146.82(a)(16) and 146.92(b).

Injection Well Plugging GSDT Submissions

GSDT Module: Project Plan Submissions **Tab(s):** Injection Well Plugging tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Injection Well Plugging Plan [40 CFR 146.82(a)(16) and 146.92(b)]

11.0 Post-Injection Site Care (PISC) and Site Closure

The Post Injection Site Care and Site Closure Plan (PISC) Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the pre and post injection pressure differential, post-injection monitoring plan, alternative post-injection site care timeframe, non-endangerment demonstration criteria, site closure plan and QASP.

An Alternative PISC timeframe has been proposed as part of the GSDT submission. CapturePoint Solutions, LLC has indicated an alternative PISC timeframe of 10 years instead of the default 50 years.

The Post Injection Site Care and Site Closure Plan satisfies rule requirements 40 CFR 146.82(a)(17) and 146.93(a) and the Alternative PISC submission satisfies rule requirements 40 CFR 146.82(a)(18) and 146.93(c).

PISC and Site Closure GSDT Submissions

GSDT Module: Project Plan Submissions

Tab(s): PISC and Site Closure tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ PISC and Site Closure Plan [40 CFR 146.82(a)(17) and 146.93(a)]

GSDT Module: Alternative PISC Timeframe Demonstration

Tab(s): All tabs (only if an alternative PISC timeframe is requested)

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Alternative PISC timeframe demonstration [40 CFR 146.82(a)(18) and 146.93(c)]

12.0 Emergency and Remedial Response

The Emergency and Remedial Response Plan has been submitted via the GSDT in 'Confidential Business Information' form. All Tabs that require input data within the module have also been completed and submitted via the GSDT. A 'Confidential Business Information' version has been submitted to Region VI of EPA as well.

The report covers in detail the local resources and infrastructure, potential risk scenarios, response personnel and equipment, emergency communications plan, a plan review and staff training and exercise procedures.

The Emergency and Remedial Response Plan Report satisfies rule requirements 40 CFR 146.82(a)(19) and 146.94(a).

Emergency and Remedial Response GSDT Submissions

GSDT Module: Project Plan Submissions **Tab(s):** Emergency and Remedial Response tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Emergency and Remedial Response Plan [40 CFR 146.82(a)(19) and 146.94(a)]

13.0 Injection Depth Waiver and Aquifer Exemption Expansion

An injection depth waiver is not required for this permit application.

Injection Depth Waiver and Aquifer Exemption Expansion GSDT Submissions

GSDT Module: Injection Depth Waivers and Aquifer Exemption Expansions **Tab(s):** All applicable tabs

Please use the checkbox(es) to verify the following information was submitted to the GSDT:

☑ Injection Depth Waiver supplemental report [40 CFR 146.82(d) and 146.95(a)]

☑ Aquifer exemption expansion request and data [40 CFR 146.4(d) and 144.7(d)]

14.0 Other Information

CapturePoint Solutions, LLC utilized the EJScreen: Environmental Justice Screening and Mapping Tool (Version 2.0) (https://ejscreen.epa.gov/mapper/) to identify issues with respect to the proposed Rapides One CCS Site. At this time no instances of the listed indexes in the tool were identified to be impacted or exacerbated by the proposed GS project.